The Geology and Hydrogeology of the Teays-Mahomet Aquifer System in East-Central Illinois

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By

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Abstract

The Teays River was a large system flowing—in what are now the states of Virginia, West Virginia, Ohio, Indiana, and Illinois—from the Tertiary period until glaciation in the Pleistocene. Glaciation during the Pleistocene turned the region through which the Teays River flowed into a region of aquifers. The system of aquifers created during this glaciation in the study region is known as the Teays-Mahomet Aquifer System (TMAS). The TMAS is an extensive formation spanning across the Midwestern United States. Specifically, the study focuses on the TMAS in east-central Illinois. The Mahomet Sand Member and Glasford formation are a few of the aquifers in the TMAS that have been useful sources of water.

The TMAS provides water for residential, agricultural, and industrial needs in the region. The recharge rates and groundwater flow properties of the Mahomet Sand Member allow it to be a dependable source of groundwater. The impact of high rates of withdrawal in cities—like Champaign—within the study region has had impacts on the TMAS as a whole. Various cones of depression are changing the natural groundwater flow directions within the TMAS. Usage models show that the current rates of water withdrawal will continue to be sustainable, even with increases in usage. Potential contaminations, including landfill leakage and arsenic concentration, may create causes for concern in the longevity of the aquifer.

Acknowledgements

Thank you to all faculty of the School of Earth Sciences at The Ohio State University who have helped me throughout my undergraduate career. Without you, I would not be where I am today. I'd like to thank Dr. Schwartz specifically for being my research advisor and helping me complete my thesis. His guidance and recommendations were the most significant help I received throughout the process. Additionally, I'd like to thank Dr. Carey for her help and support throughout my time studying Earth Science at Ohio State. Also, I'd like to give a special thank you to Dr. Audrey Sawyer for sparking my interest in hydrogeology in E.S. 1121 and again in her hydrogeology class. Special thanks to Dr. Darrah for showing me that you can have fun in the middle of nowhere at field camp. Thank you to my dad, mom, brother, and dog for also being supportive throughout my time as a Buckeye. Thank you to anyone and everyone who helped me develop the skills throughout my life to make this possible, go Bucks.

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Introduction

The use of groundwater as a resource in the United States has increased as the demand for water usage continues to rise with the rising population. Buried valley aquifers have been particularly important in the Midwest, filling the demand for a clean and reliable source of water. In this respect, one noteworthy example is the extensive Teays-Mahomet Aquifer System (TMAS). This aquifer, extending from southern West Virginia to western Illinois, has proven to be an extremely useful as a local water source across parts of this region (Kempton, et al., 1991).

A buried valley aquifer is typically composed of alluvial sand or gravels occurring along the bottom of valley that are subsequently filled with glacial tills in later glacial advances. Often filling is so complete that there is little in the way of topographic evidence of the former valley system.

The overall objective of this study is to describe the TMAS from a hydrogeologic perspective. Portions of this system, especially through central Illinois are being stressed by excessive removals of groundwater and local sources of contamination.

Geologic History Teays River System

The Teays River was a large pre-glacial system draining much of eastern and central North America. The origins of the river system can be traced back to the Tertiary Period when it flowed northward across present-day Virginia and West Virginia and westward across present-day Ohio, Indiana, and Illinois. The Teays River system has had a lasting hydrologic influence on the region. For example, its largest tributary became the Old Kentucky River. While the former Teays River valley is larger buried today, the detailed work of previous geologists discovered that the Teays River and its tributaries flowed in a direction 180° to the current Scioto River (Teller and Goldthwait, 1991).

Around two million years ago, during the Pleistocene, glaciation buried and destroyed much of the Teays River. The glaciated part of the Teays River basin is shown in Figure 1.

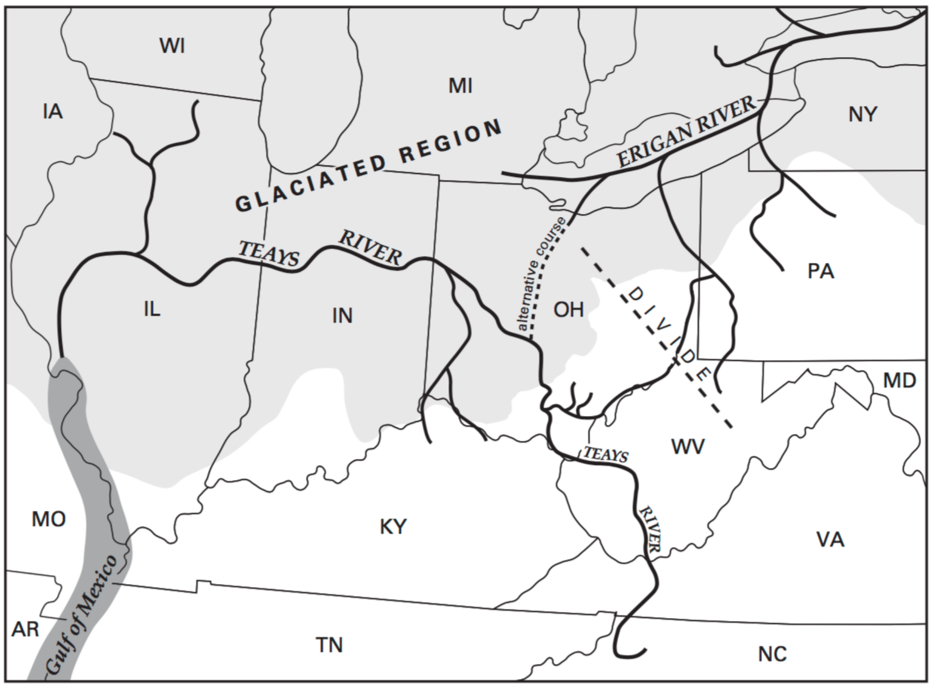


Figure 1: Map showing the Teays River System during the Pleistocene and the regions that experienced glaciation (Image from the Ohio Geologic Survey).

The earliest ice advances during the Pleistocene altered surface-water drainage patterns in eastern North America. The Teays River was effectively dammed in southern Ohio as a result of ice sheets to the northwest. This led to formation of large lakes such as Lake Tight, located near the present-day cities of Chillicothe, Portsmouth, Athens, and Marietta (Teller and Goldthwait, 1991). The overflow associated with these glacial lakes led to new drainage ways like the Ohio and Scioto Rivers forming. The valleys of the

Teays River system, including its tributaries, were filled with sediment during the glaciation process. Figure 2 demonstrates the formation of the Mahomet aquifer in two stages. First, glaciation filled the stream valley. The stream valley ended up about 100 meters below the surface and makes up the Mahomet Aquifer.

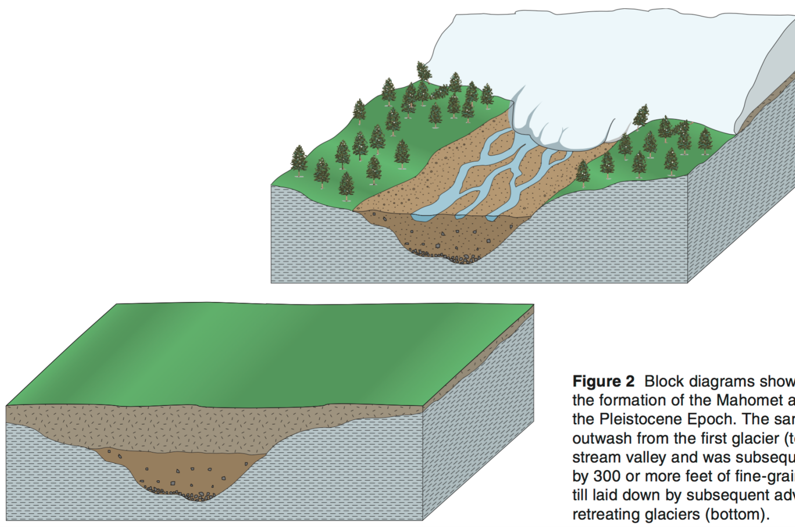


Figure 2 Block diagrams showing stages in the formation of the Mahomet aquifer during the Pleistocene Epoch. The sand and gravel outwash from the first glacier (top) filled a stream valley and was subsequently buried by 300 or more feet of fine-grained glacial till laid down by subsequent advancing and retreating glaciers (bottom).

Figure 2: A diagram of how the Mahomet aquifer formed with glaciation in the Pleistocene. Caption in figure is directly quoted from source. (Figure from Canavan et al., 2005)

Description of Study Area

The western part of the Teays system of buried valley aquifers is called the Mahomet Valley Aquifer. It is this portion of the Teays system in central Illinois that is the focus of the present study. Unlike other parts of the Teays system in Ohio and West Virginia, the buried-valley sediments there constitute a major regional source of groundwater. Figure 3 shows the study area for my investigation on a larger scale. The study area is approximately 4,000 km^2 and covers a large portion of the Mahomet Aquifer. While the study has focused on the Mahomet Sand Member and the Glasford Formation, many components of the Mahomet Valley System were addressed. The region was chosen because of the availability of data and the importance of the aquifer to the area. The longevity of the Mahomet Aquifer will control future living standards for Eastern and Central Illinois as the demand for water in the region continues to rise.

Figure 3: This red box shows the location of the study area in the Midwest.

The aquifer is located in central Illinois (Figure 4) where many cities depend on it for a source of water. The aquifer provides a source of clean water for nearly 1 million people. The cities of Champaign, Normal, and Decatur consume the largest quantities of water from the Mahomet Valley Aquifer. Champaign has the largest population of the three at 230,000, while Normal has a population of 50,000 and Decatur 72,000. The aquifer is used for primarily for irrigation of agricultural crops in the region, but as population continues to rise the municipality demands will do the same.

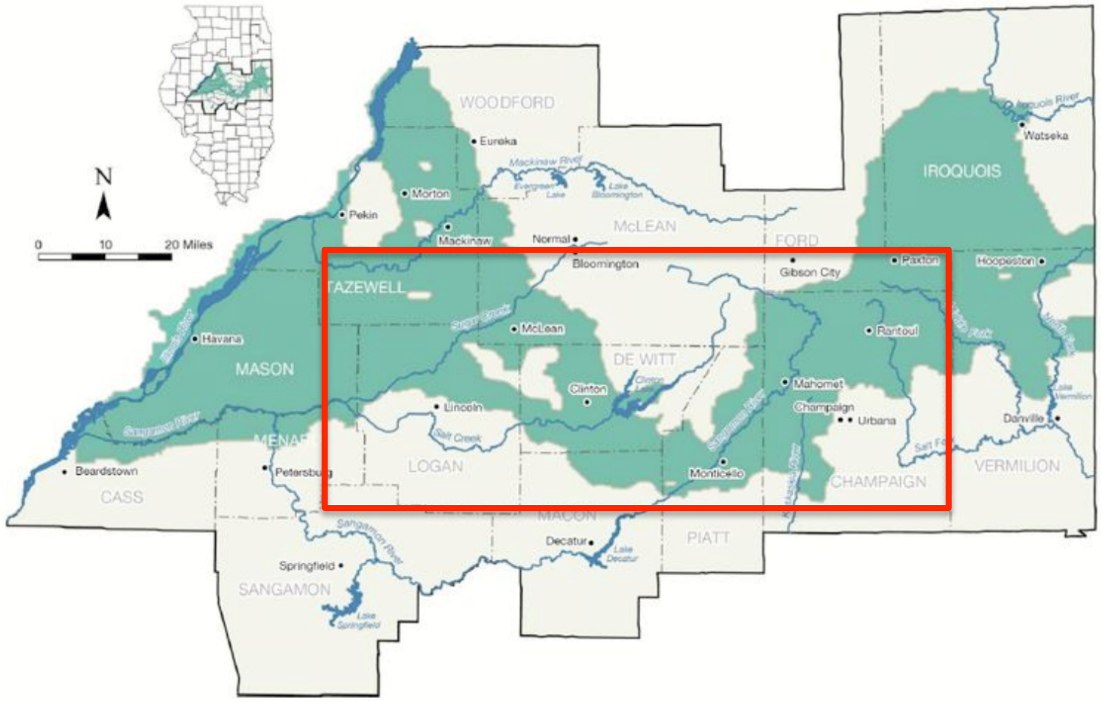


Figure 4: A closer look at the Mahomet aquifer region. The study area once again is outlined in red. (Figure from Knapp et al., 2011)

Climate

The climate of in and around the study area can be described as a continental climate with no dry season, severe winters, hot summers, and high variability in temperatures. Table 1 shows the mean monthly average temperature and precipitation for Champaign-Urbana - a metropolitan area within the study area. The warmest month is July with an average high of 28.1 °C and a low of 18.3 °C, while January is the coldest with an average high of 0.5 °C and an average low of -8.5 °C. The largest rainfalls typically occur in the late spring around May with an average of 124.2 mm a month. The highest average snow fall occurs in January with an average of 172.7 mm. Precipitation as snow is important to reference because a large portion of the source water for the aquifer recharges in the area comes from snowmelt (Panno et al., 1994).

Table 1: Monthly averages in temperature, rainfall, and snowfall for Champaign-Urbana. (Source: National Weather Service)

Month	Average High (°C)	Average Low (°C)	Average Rainfall (mm)	Average Snowfall (mm)
January	0.50	-8.50	52.07	172.72
February	3.17	-6.56	54.10	147.32
March	9.94	-1.11	72.64	66.04
April	17.11	5.06	93.47	10.16
May	23.00	10.89	124.21	0
June	28.06	16.61	110.24	0
July	29.44	18.28	119.38	0
August	28.72	17.28	99.82	0
September	25.67	12.33	79.50	0
October	18.44	5.89	82.80	2.54
November	10.33	0.00	93.47	22.86
December	2.61	-6.00	69.34	167.64
Annual	16.50	5.39	1051.05	589.28

Topography and Land Cover

The topography is generally flat-lying. Relief is low, approximately 3-6 m, with lower areas produced mostly by down-cutting along streams. Because the study area lies within the Bloomington Ridged Plain, higher areas are the result of end moraines forming broad ridges. Because the region was created from more recent glaciation, post-glacial streams cut through the Bloomington Ridged Plain less than surrounding areas. The entire region is fairly flat with average slopes having less than a 3% grade. The dominant soil in the region consists of silty-clay loams. The soils has a generally moderate permeability, which permits relatively high water infiltration (Knapp et al., 1985).

This part of Illinois has proven to be an ideal place for farming because of the flat lands and rich soils. The development of agriculture across this region has depended greatly on the availability of high quality groundwater. Figure 5 shows a topographic map of the bedrock valley where the Mahomet Aquifer is located. The land of the study area encompasses regions that support both urban and rural environments. According to the Illinois State Geologic Survey, slightly greater than 75% of land in the study region is used for agricultural purposes.

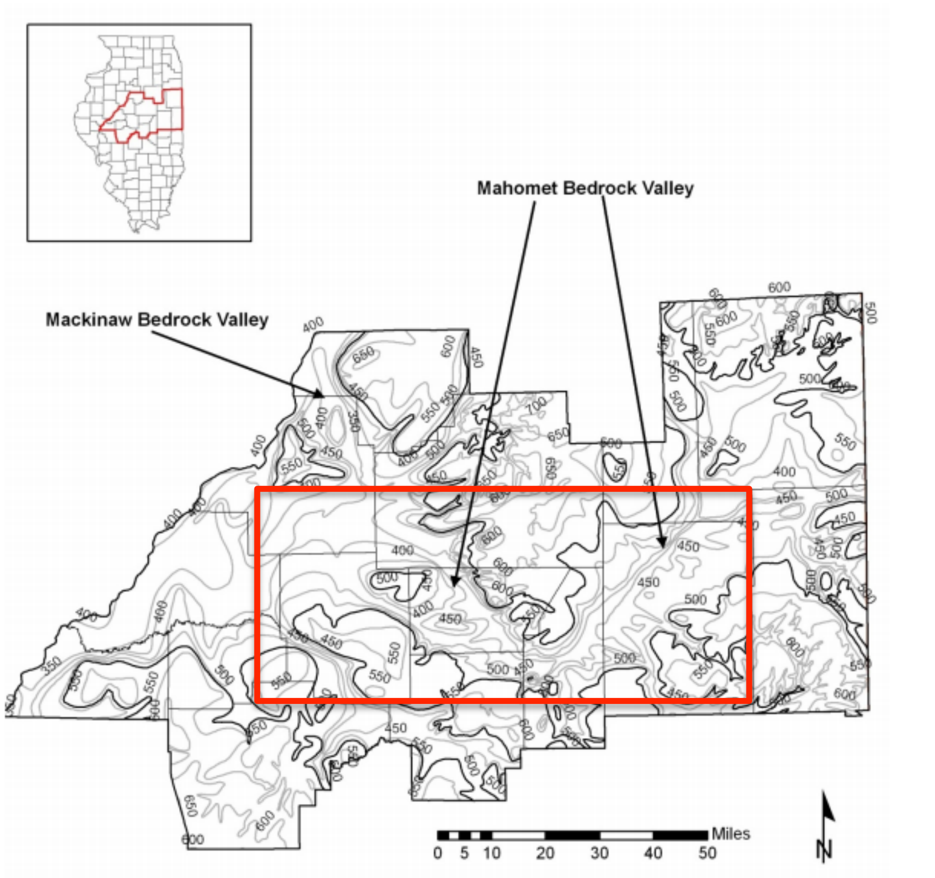


Figure 5: Topographic map of the Mahomet Bedrock Valley. The study region is outlined in red. (Knapp et al., 2011)

Surface Water

Much of the study area lies within the Sangamon River watershed, which has an area of 13,631 km^2. The main stem of the Sangamon River is 396 km long and it is the largest tributary of the Illinois River. The Sangamon River drains much of the area that is above the Mahomet Valley Aquifer flowing east to west—matching the hydraulic head gradient in the aquifer. Most other streams in the region flow in this direction. The annual streamflow decreases slightly from the eastern to western portions of the watershed. Because the topography of the study area has relatively low relief, the streams in the region have a low gradient.

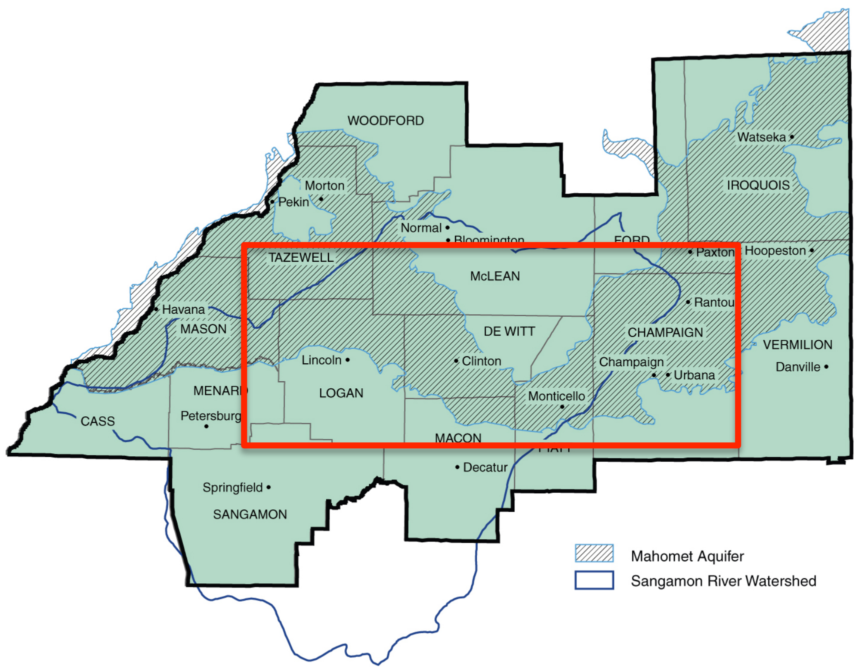


Figure 6: This map shows the area underlain by the Mahomet Aquifer as well as the Sangamon watershed in Eastern Illinois. The red box outlines the study region. (Map from the Mahomet Aquifer Consortium)

High flow conditions are frequent in May and June because of the high precipitation in these months (Table 1). Low flows occur most frequently from October to November when summer ends and precipitation is lower (Knapp et al., 1985).

Bedrock Geology

Near-surface bedrock in the region ranges in age from Silurian to Pennsylvanian (Kempton et al., 1991). Figure 7 shows the location of the Mahomet Buried Valley in relation to these shallow bedrock units. Generally, the pattern of layering is complicated by structural deformation with key anticlines and monoclines shown on the map (Hackley et al., 2010). Lithologically, these formations are composed of sandstone, limestone, dolomite, shale, and coal (Wilson et al., 1994).

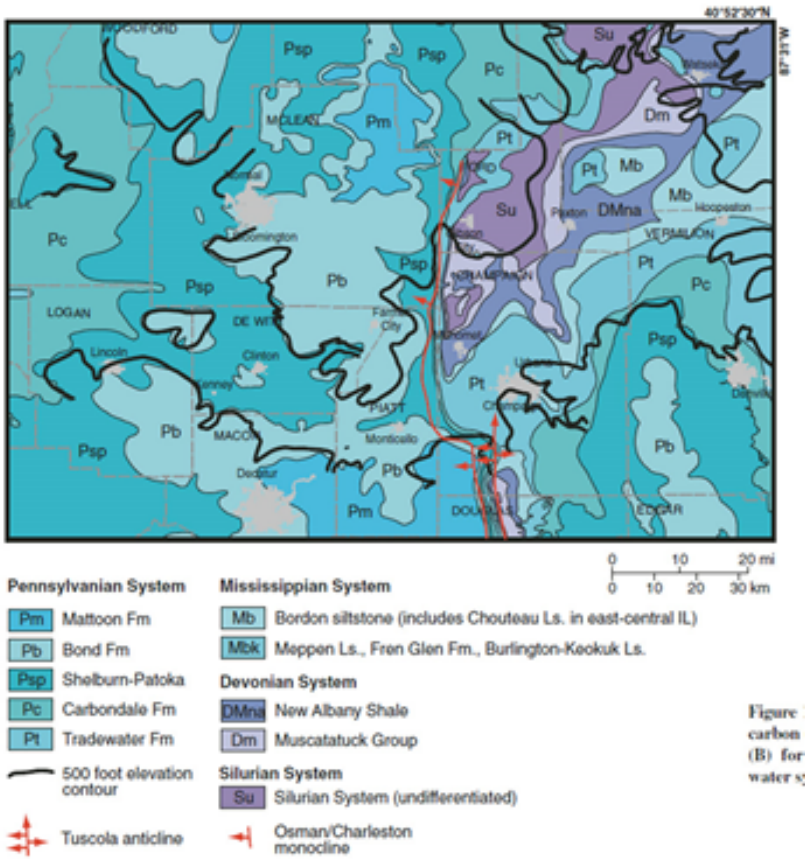


Figure 7: Bedrock geology for the area of the TMAS in east-central Illinois. (Figure from Hackley et al., 2010)

There are multiple locations where the bedrock associated with the Mahomet Valley is exposed on the surface both naturally and unnaturally. Naturally, the bedrock is exposed along stream valleys. There are several exposures throughout Eastern Illinois in strip mines and quarries. These rocks are within the Illinois Basin that is centered in southeastern Illinois and the north-south La Salle Anticlinal Belt (Kempton et al., 1991). The near surface bedrock units in Eastern-Central Illinois region can be seen in Figure 7.

The Mahomet aquifer occurs in an incised bedrock valley that is approximately 91 m deep (Kempton et al., 1991). The actual aquifer is composed of permeable sand and gravel units occurring along the valley bottom. The hydrostratigraphy is described below.

Figure 8 shows a cross-section along the axis of the buried channel. The stratigraphic units shown in the cross section are the result of three main glacial episodes during Wisconsin and Illinois glacial episodes. The upper units in the section (i.e., lb, t, gv-3, gv-2) are diamictons that are poorly sorted deposits deposited below the ice or ice-contact deposits. Units at the bottom of the Mahomet Bedrock Valley are Pre-Illinois in age with the sand and gravel members of the Banner Formation. (i.e., b-m1, b-m2) water-bearing parts of the aquifer.

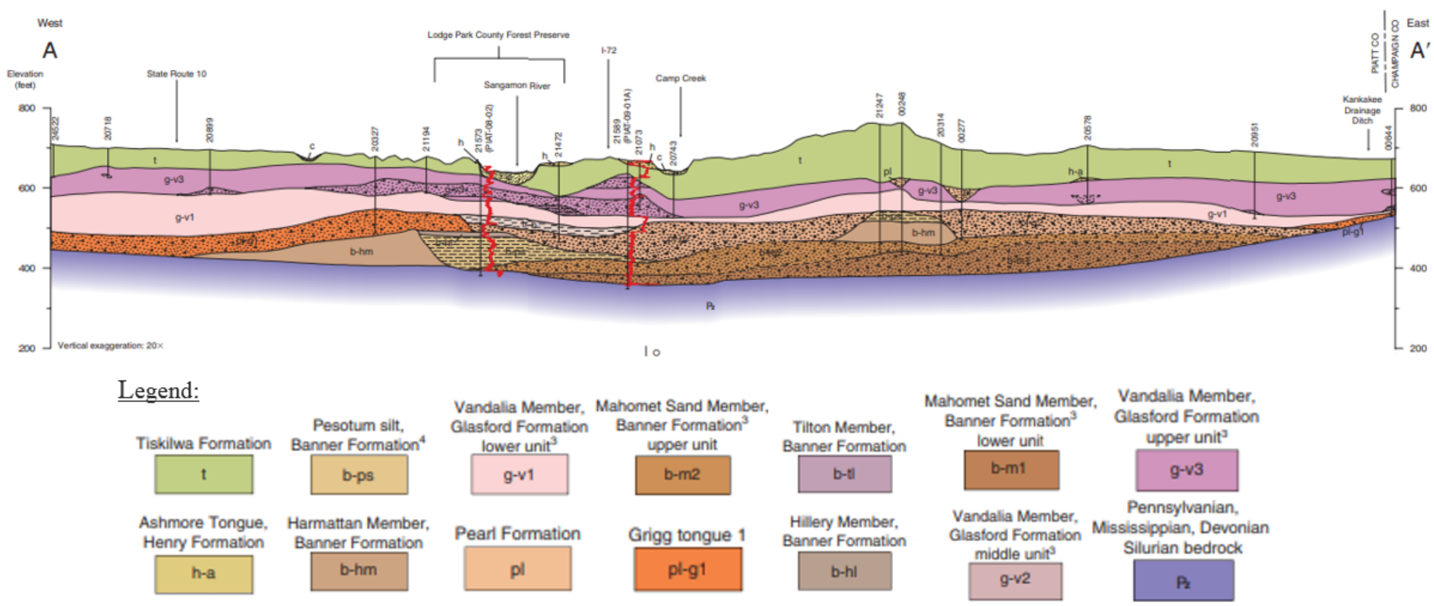


Figure 8: Cross section across portion of the TMAS within the study region (Figure from Stumpf and Atkinson 2015).

Physical Hydrogeology

Hydrostratigraphic Units

Figure 9 is a simplified description of units in the study area. The shallowest formations the Wedron Formation, and the the Glasford Formation are not consistently water-bearing. From a water resource perspective, the Mahomet Sand Members of the Banner Formation constitute the key aquifer units. These are discussed in detail in following sections.

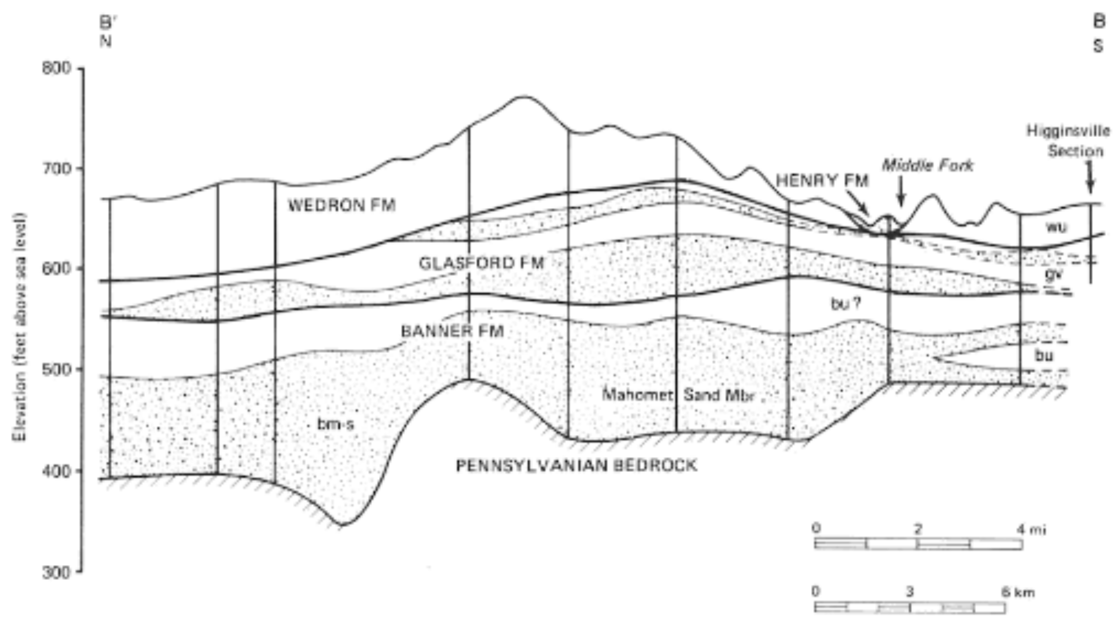


Figure 9: A simplified cross section of the region showing the water-bearing formations (Figure from Kempton et al., 1991).

Mahomet Sand Member

The Mahomet Sand Member consists of a sand facies and a silt facies (Kempton et al., 1991). The sand facies composes the majority of the aquifer, while the silt facies occurs locally in tributary valleys located around the edge of the Mahomet Valley aquifer. The sand facies is coarse-gravelly sand that fines upward. The gravel is fine to medium grained for the most part, but it also contains cobbles throughout. There are silt and sand lenses found throughout the sand facies, but the overall zones are consistent. Along the axis of the buried valley this unit is commonly > 30 m (~100 ft) (Figure 10).

The lower zone of the sand facies is correlative with sand in the Mahomet Valley in western Indiana. However, the upper zone of the sand facies originates with a drainage source to the northeast. The irregularities in the distribution of the upper zone are the result of a combination of depositional irregularities and local variations in fluvial and glacial erosion. Additional channels present may have also affected the depositional environments of the sand facies (Kempton et al., 1991).

Figure 10 shows the locations of the silt and sand facies in the Mahomet Sand Member. The silt facies of the Mahomet Sand Member is comprised of a combination of clay and silt sediments and limited in extent to tributary valleys along the main valley. It is generally somewhat thinner than the sand facies. The silt facies sediment is largely calcareous with mostly lacustrine origins (Kempton et al., 1991). Non-glacial alluvium is not known to occur beneath the silt facies of the Mahomet Sand Member.

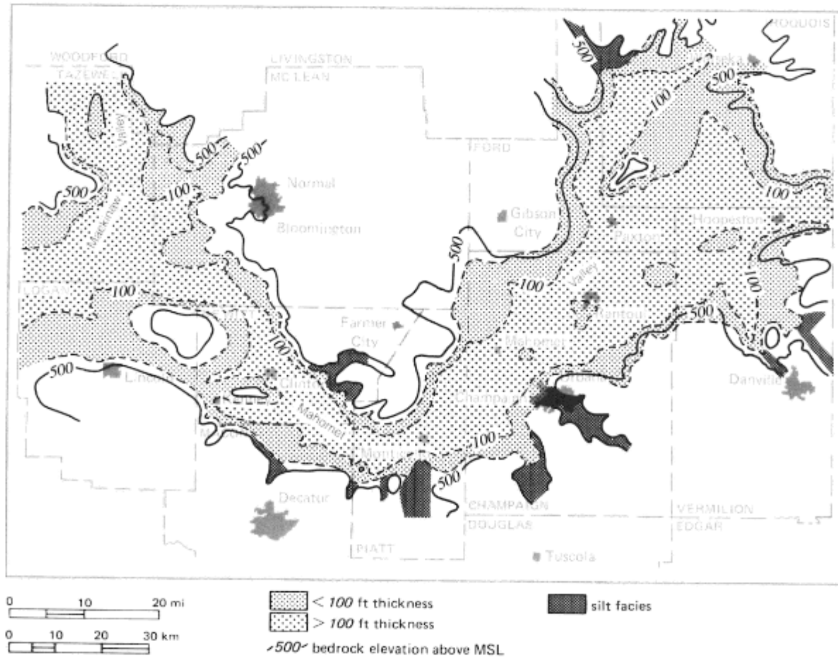


Figure 10: Map of the Mahomet Sand Member showing varying thickness and the location of silt facies (Figure from Kempton et al., 1991).

The Mahomet Sand Member as a Resource

The Mahomet Sand Member is the largest source of water from the TMAS in the east-central Illinois region. In 1982, the estimated pumpage from the Mahomet Sand Member was 200,000 m^3 per day. The Champaign-Urbana area was the largest recorded user in 1982 with a maximum pumpage of about 64,000 m^3 per day (Kempton et al., 1991). A more detailed discussion of water usage in the study area will be presented later.

Glasford Formation

The Glasford Formation overlies the Mahomet Sand Member. It is thinner than the Mahomet Sand Member and mostly occurs between glacial tills. As shown in Figure 11, the Glasford Formation is not so extensive as the Mahomet Valley Aquifer. The composition is mostly sand and gravel deposits associated with Vandalia till. There are few data available on the composition of the Glasford Formation. However, it is locally viable as a water supply and is a useful source to several small population centers (Kempton et al., 1991).

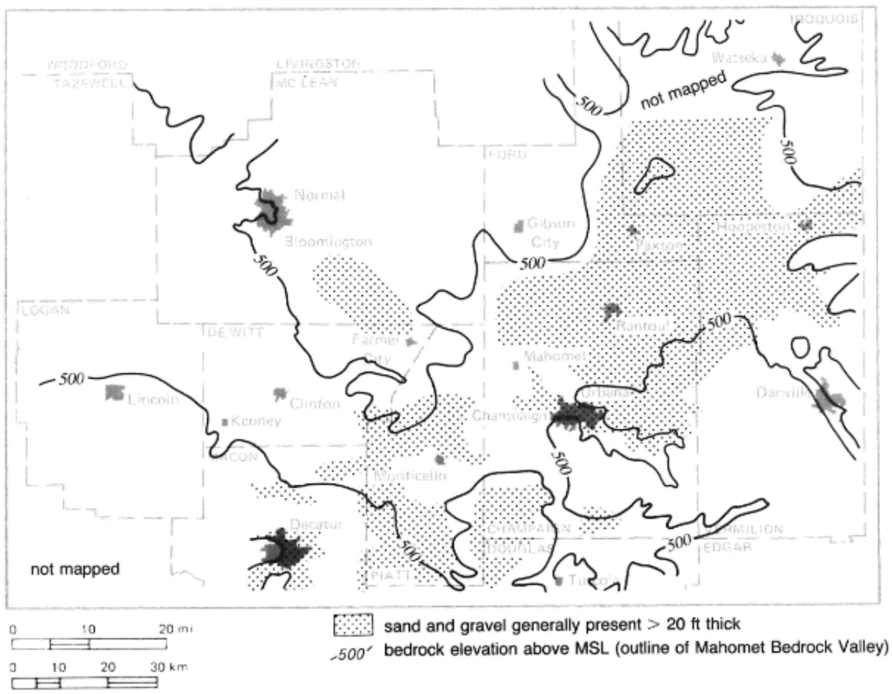


Figure 11: A map of the Glasford Formation in the TMAS showing the distribution of sand and gravel (Figure from Kempton et al., 1991).

The Glasford Formation as a Resource

Because the Glasford is a smaller aquifer located on top of the Mahomet Sands, it is used mainly for agricultural purposes. It supplies water to small communities, industries, and farms. Champaign-Urbana withdraws water from this aquifer, but at rates much lower than its withdrawals from the Mahomet Sands, at ~8,000 m^3 per day (Kempton et al., 1991). The yields to wells completed in the Glasford aquifer are much more variable than the Mahomet. The local thickness, composition, and porosity of the aquifer determine its usefulness.

Recharge Properties

Recharge to the Mahomet Valley Aquifer comes from a combination of precipitation and snowmelt. The annual recharge rate for the Mahomet Sand Member specifically is estimated to be 250 m^3 per km^2 (Kempton et al., 1991). Figure 12 is a conceptual model illustrating how the Mahomet Aquifer is recharged (Knapp et al., 2011). The model provides a look at how glacial till and the sand member of the TMAS interact with each other. The high porosity and permeability of the Mahomet Sand Member are the reasons it is the most water-bearing formation in the region. The hydraulic conductivity of the glacial till is much lower than that of sand. This makes glacial till poor for a groundwater supply in the TMAS. The arrows in Figure 12 demonstrate this as they show downward flow generally following the more permeable sand lenses. The model is a simplistic view, but shows regional high and low recharge areas in the TMAS.

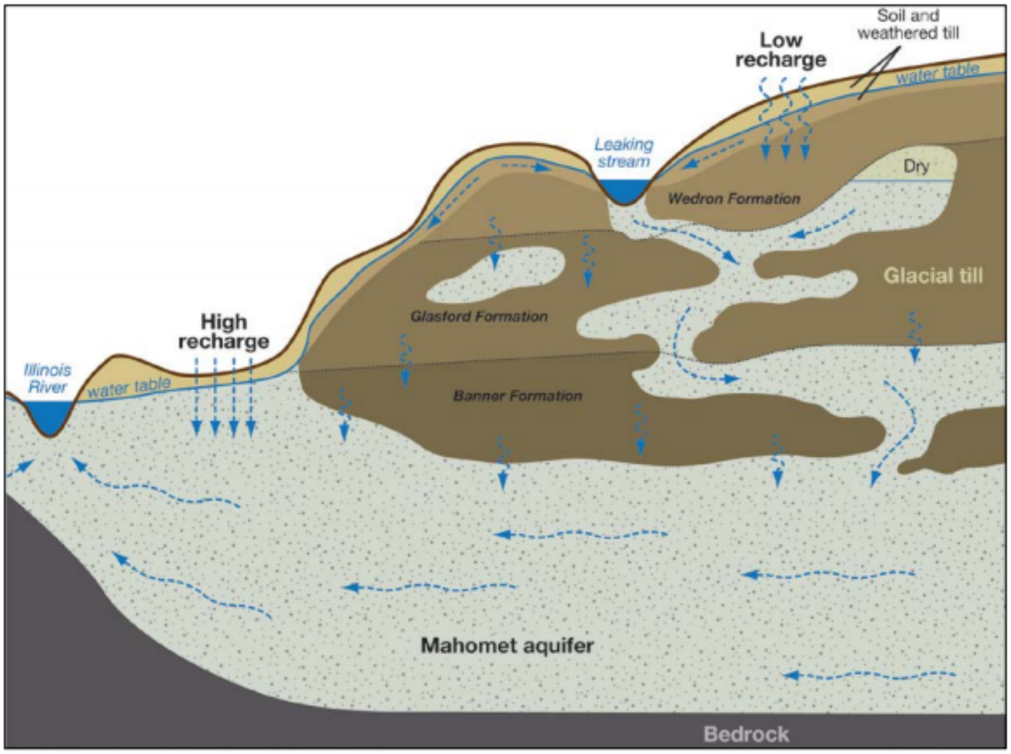


Figure 12: A conceptual model of recharge in the TMAS study area (Figure from Knapp et al., 2011).

Groundwater Movement

Groundwater flow in the Mahomet Sand Member differs from that within the shallower units, e.g, the Glasford. Figure 13 shows areas of higher hydraulic heads to the east. Lower heads occur at the western end of the aquifer. This distribution in hydraulic head generally result in east-to-west flows. However, pumping in places like Champaign-Urbana produce deep cones of depression. The cone of depression at Champaign-Urbana is evident in the potentiometric map (Figure 13). The map shows a significant decline in water levels of ~15 meters in the Mahomet aquifer. The majority of the TMAS within the study region is a confined aquifer, but that will most likely change in the future due to continued pumping.

The groundwater discharge of the aquifer system is not very well understood. However, it is likely that discharge from within the study region travels through Silurian dolomite regionally connected to streams (Knapp al., 2011).

The flow in the Glasford aquifer is more complex, given its smaller size and spatial variability. Water levels are most likely regionally controlled by the conditions in the Mahomet Sand Member (Kempton et al., 1991).

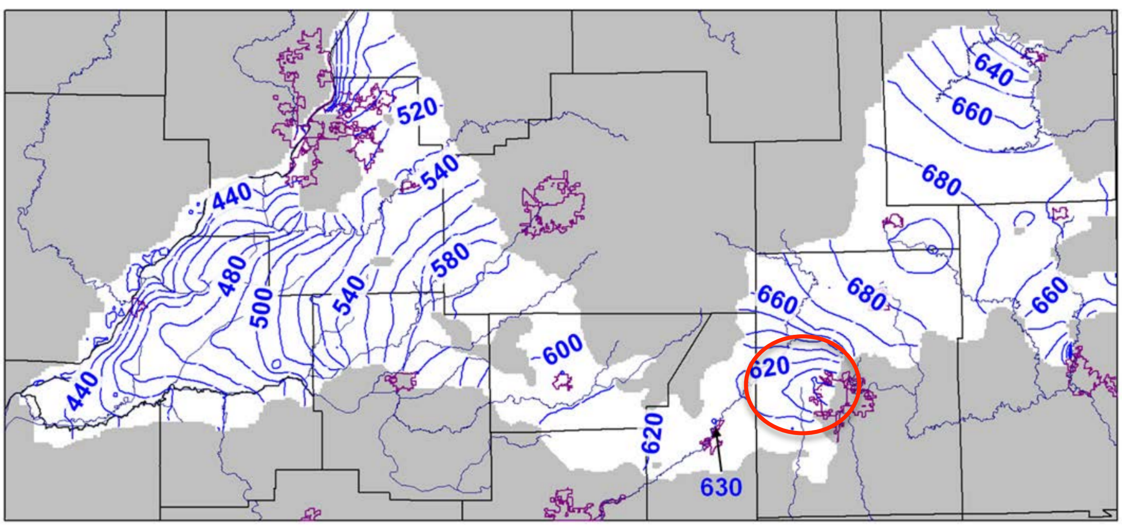
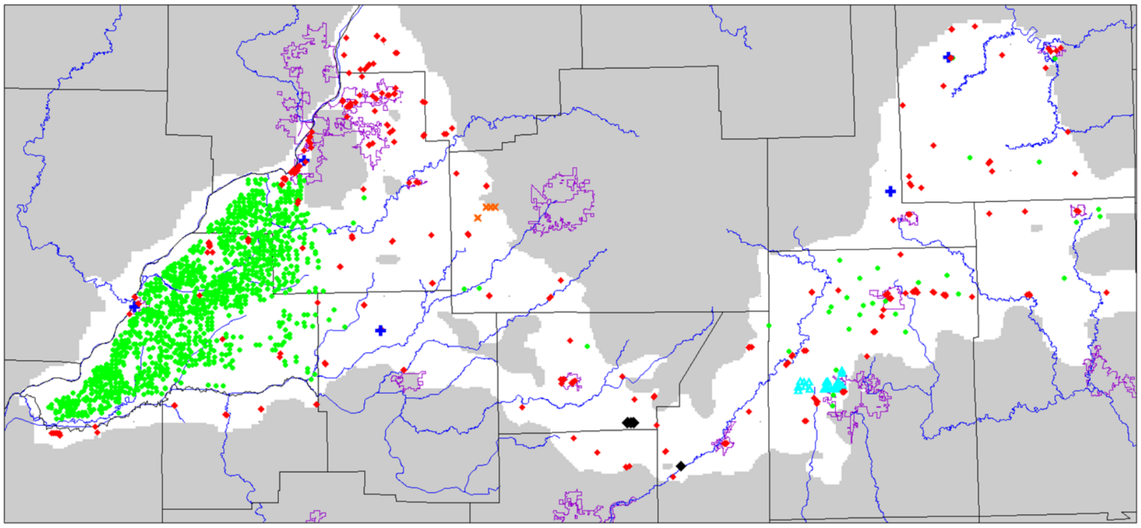


Figure 13: A potentiometric surface map of the Mahomet Aquifer in 2009. The cone of depression due to pumping at Champaign-Urbana is indicated by the red circle (Figure from Knapp et al., 2011).

Discussion

Groundwater Sustainability



Legend: green dots – irrigation wells; red diamonds – public and commercial wells; orange crosses – Normal wells; black diamonds – Decatur emergency wells; cyan triangles – IAWC Champaign wells; open cyan triangles – new IAWC Champaign wells; blue crosses – hypothetical new industrial plant wells.

Figure 14: Map showing the general distribution of high capacity wells in the TMAS across the region. (Figure from Knapp et al., 2011).

Figure 14 shows a distribution of wells in the TMAS. Within the study region, there are irrigation wells, public wells, commercial wells, and emergency wells. The diversity of the types of wells in the region highlights the importance of the TMAS as a water source in the region. Also, the abundance of wells across the TMAS is evidence of the importance of the system. The impacts on the aquifer of drawing this much water from the wells can already be seen today and will continue to be seen in the future.

As discussed earlier, the high rates of withdrawal in and around Champaign-Urbana have already created a cone of depression in the TMAS. Figure 15 shows the water elevation in a well near Champaign-Urbana from 1950 to 2010. The decline in the water level from 198 meters to roughly 180 meters in a 50-year period creates cause for concern. Also of concern is continuing drawdown in the well, although the rate of drawdown is slowing somewhat (Knapp et al., 2011).

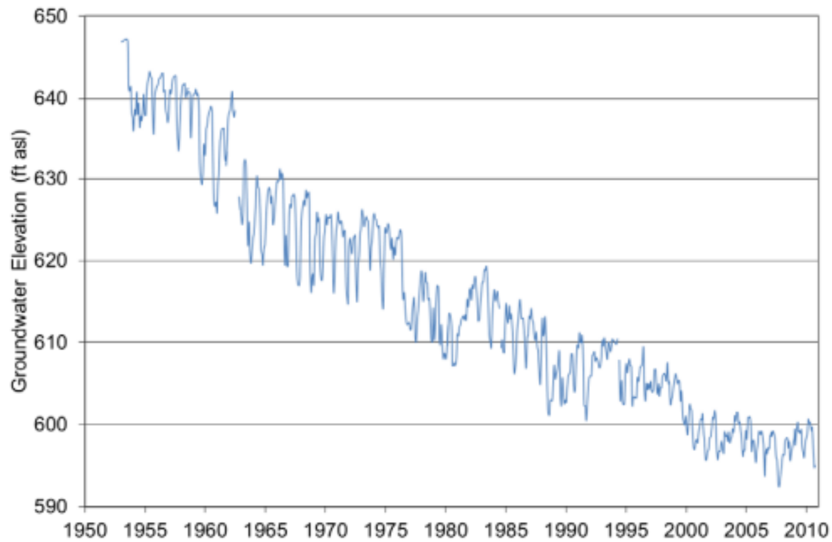


Figure 15: Hydrograph of well monitoring water-level declines due to pumping at Champaign-Urbana (Figure from Knapp et al., 2011).

Longevity Concerns

As the population across the United States increases, there will continue to be higher demand not only for living space, but also for food. Because this part of Illinois is important agriculturally and industrially, increased water usage can be expected in the future. Figure 16 is a projection of pumping rates from the Mahomet Aquifer based on three projections: Baseline, More Resource Intensive, and Less Resource Intensive (Knapp et al., 2011). As seen in the figure, even with more moderate and efficient usage of the groundwater supply, a large increase in groundwater utilization from the Mahomet aquifer can be expected.

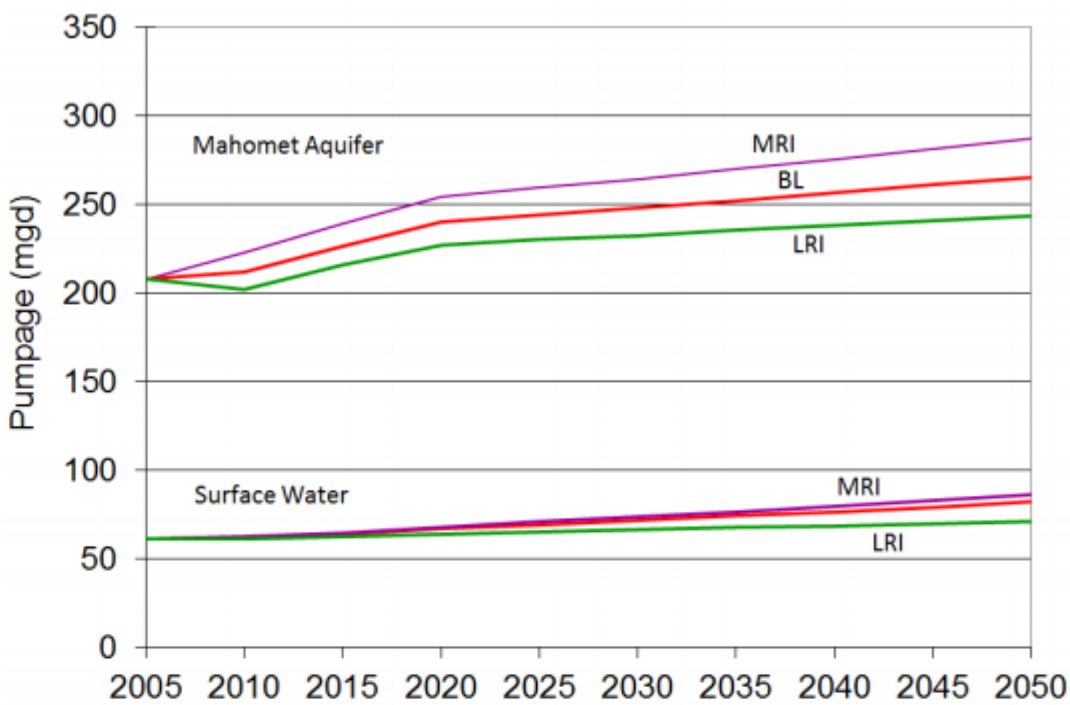


Figure 16: Projections for the utilization of groundwater projections up to 2050 from the Mahomet Aquifer and surface water in the region. MRI: More Resource Intensive.. BL: Baseline. LRI: Less Resource Intensive (Figure from Knapp et al., 2011).

Table 2 shows results from the model for predicted usage for water in the region of the Mahomet Aquifer in 2050. The largest increase predicted by the model is in commercial and industrial water usage as the cities in the region continue to grow—180% from between 2005 and 2050 is predicted. From these increases, more cones of depression will likely form. An increase in size and impact from those already existing in the TMAS is also expected. However, even at the more-resource intensive scale of the model, none of the current groundwater uses of the TMAS in study region is considered to pose a risk for creating a future water crisis (Knapp et al., 2011).

Table 2: This chart adopted from modeling by (Knapp et al., 2011) shows water withdrawals in 2005 compared with predicted water demands of 2050.

Sector	2005 m^3/day	2050 m^3/day	Change (%)
Public Supply	481,655.79	669,563.64	39.0
Commercial/Industrial	241,130.73	520,531.97	115.9
Self-supplied Domestic	33,538.75	45,462.80	35.6
Irrigation/Agriculture	527,686.40	705,827.88	33.8
Subtotal	1,284,011.68	1,941,386.29	51.2
Power Generation	4,979,141.38	4,828,444.14	-3.0
Total	6,263,153.06	6,769,830.43	8.1
Public Supply	481,655.79	581,060.71	20.6
Commercial/Industrial	241,130.73	439,751.29	82.4
Self-supplied Domestic	33,538.75	45,462.80	35.6
Irrigation/Agriculture	527,686.40	670,812.82	27.1
Subtotal	1,284,011.68	1,737,087.61	35.3
Power Generation	4,979,141.38	4,609,798.76	-7.4
Total	6,263,153.06	6,346,886.37	1.3
Public Supply	481,655.79	701,663.93	45.7
Commercial/Industrial	241,130.73	675,771.71	180.2
Self-supplied Domestic	33,538.75	45,462.80	35.6
Irrigation/Agriculture	527,686.40	741,070.06	40.4
Subtotal	1,284,011.68	2,163,968.50	68.5
Power Generation	4,979,141.38	5,081,423.21	2.1
Total	6,263,153.06	7,245,391.71	15.7

Legend: Black: baseline track, Blue: less resource intensive track, Red: more resource intensive track.

Potential Contamination Threats

While the TMAS will likely continue to provide the study region with a source of groundwater for the coming years, contamination threats could jeopardize its sustainability. Arsenic is a natural occurring contaminant found in the Mahomet aquifer. Arsenic has been seen mostly in deeper parts of the TMAS. The arsenic is naturally occurring, dissolved from various minerals in deep bedrock and shallow glacial materials, which is why it can be found in the TMAS in the study area. In the groundwater, arsenic is generally occurs as a dissolved inorganic form. When present above MCLs (i.e., 10 μg/L) arsenic in drinking water can put consumers at increased risk for various forms of cancer. The addition of iron to the groundwater or ultra-filtration techniques are possible treatment solutions to reduce arsenic concentrations in drinking water derived from the TMAS (Holm 1995).

There are multiple anthropogenic contaminants affecting the quality of water in the Mahomet Aquifer today. There are traces of nitrate from agricultural fertilizers and chloride applied in winter for snow removal on roads. These influxes can make the groundwater difficult to use because of the extra monitoring and treatment that may be required.

New landfill sites also create concern for potential contamination of the aquifer. The Clinton Landfill, located within the study region, was just designated a hazardous contamination site (Kay and Buszka, 2016). Figure 16 shows the location of the Clinton Landfill within the study region. It is located directly above a portion of the sand member of the TMAS that serves as a resource for Clinton, Illinois. A look into the hydraulic properties of the region indicates the potential for leakage to reach the underlying TMAS even with the proper integration of hazardous waste landfill techniques (Kay and Buszka, 2016).

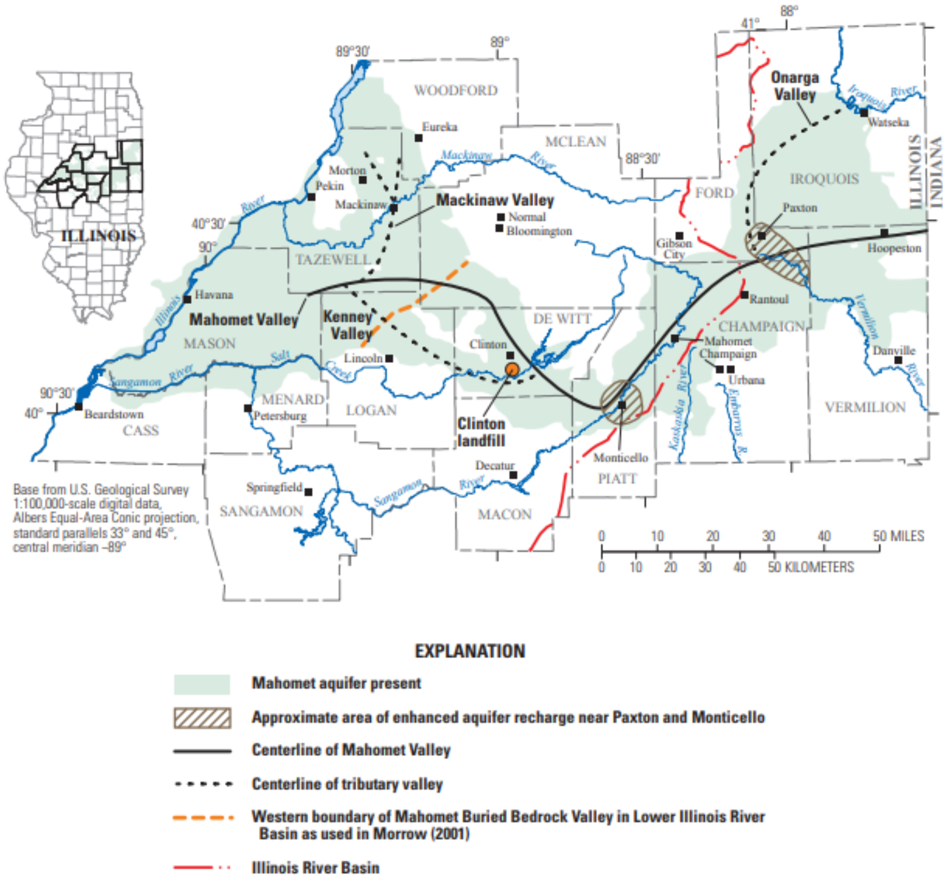


Figure 17: A map of the TMAS with the Clinton landfill site indicated (Figure from Kay and Buska, 2016).

Conclusion

Nearly 1 million people—90% of the population—in the eastern and central Illinois region rely on the Mahomet aquifer for groundwater. Because it has been declared a "Sole Source Aquifer" by the US Environmental Protection Agency, the aquifer is extremely important (Knapp et. al 2011). As industries in the region continue to grow, more people will rely on the glacial aquifers here as a water source. Luckily, the recharge rates of the Mahomet aquifer are quick enough to continue usage into the foreseeable future. The high precipitation rates and groundwater flow properties discussed in this study make the area capable of handling growth in industry and population. While the surface water sources are more susceptible to extreme climatic events, like drought, the groundwater supply in the TMAS is less influenced. The main impact on the groundwater in the TMAS has been the result of human activities. Large withdraw rates do have an impact on the hydrologic properties of the TMAS. There is reason to be wary of high capacity wells, like those at Champaign-Urbana, because a change in hydraulic head can disrupt the groundwater flow properties of the region. However, all models discussed in the study show the TMAS being able to handle the current growth rates and projections.

The importance of awareness of usage within the industries and populations in the area parallels the importance of the preventing contamination of the aquifer. While there are natural contaminants like arsenic in the TMAS, the impact of man-made contaminants could have drastic effects on the TMAS water quality. The leakage of natural gas from a subsurface storage facility and in disposing contaminants to local landfills has put the longevity of the TMAS at risk. Chemical leaks into the aquifer seem to be occurring more frequently at sites within the study region. People here are highly dependent on the TMAS for clean water and so, the aquifer must continue to be monitored frequently to avoid contamination disasters. A disruption in clean water supply to the region would have an immediate impact on the local population and the national population. The halt of agricultural production in the area would create an economic issue for the United States. Preserving the longevity of the TMAS is essential for a sustainable living environment.

Recommendations for future work

A large amount of research has already been conducted on the geology and hydrogeology of the TMAS. However, due to the importance of this water supply, more research is needed to ensure that the demand of the TMAS in the region can continue to be met. Additional well monitoring and modeling needs to be conducted to further understand the relationship between the aquifers in the region. More seismic profiling can be done to gain a better understanding of the hydrostratigraphy. As the cost of drilling test holes goes down with the advancement of technology in the oil and gas field, more drilling should be done to gather additional information on the Mahomet Valley aquifer system. As the cities in the region—just like the world—continue to have increases in population, the aquifer system will need to be watched more closely. An aquifer system as dependable and self-sufficient as the TMAS should be treated with care and used to last.

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